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(54) Method and apparatus for making lithographic printing plates in an automated computer to plate imaging system

(57) The primary function of the handler (18) is to make plates (26) available on demand to the imaging engine (20). A multitude of plates are stored inside cassettes (24) and these cassettes are loaded into the handler. There may be up to four cassettes residing in the handler. Inside a cassette there may be a protective interleaf sheet, sometimes called a slip sheet, between each plate which is removed by the handler and discarded. The handler receives commands from the engine control sequencer (12) which provides instructions as to what cassette needs to be accessed to make a plate available to the picker mechanism (28) so the plate may be conveyed to the imaging engine. Conversely the handler provides status information to the engine to make full interaction with the system possible.

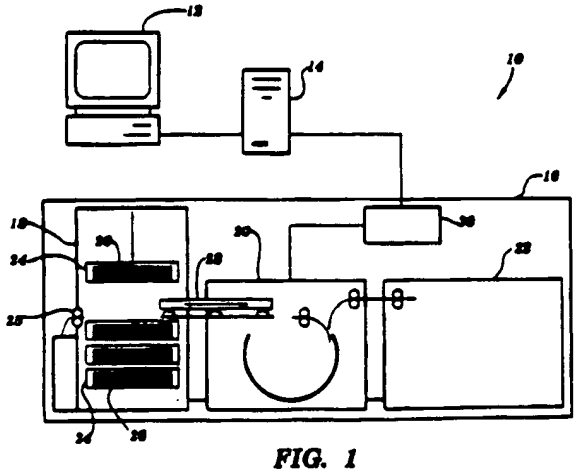

FIG. 1

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pick a plate from the top of a stack of plates and deliver the plate to the platemaker engine in a manner which accommodates a variety of plate sizes and formats.

SUMMARY OF THE INVENTION

A method and apparatus are disclosed for making printing plates in an automated computer to plate imaging system. The method and apparatus perform the steps of transferring a digital file representing an image to be printed from a front end server to a RIP. Then, the system processes the digital file in the RIP to a job to be outputted by an automated platesetter and sends the processed job from the RIP to an imaging engine in the platesetter. A plate handler in the platesetter is informed of a plate size required by the job in the imaging engine. The system automatically positions a plurality of stacks of plates stored in the plate handler to place a stack of the plate size required by the job in an access position relative to the imaging engine. Then a single plate is automatically removed from the stack of plates in the access position and delivering the plate to the imaging engine. Next a job is imaged onto the plate in the engine in the image represented by the digital file, and finally the imaged plate is processed in a processing device.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and features of the invention will be better understood and further objects and advantageous of the invention will become apparent in the following detailed description of the invention, when taken with the accompanying drawing(s), in which:

Figure 1 is a schematic illustration of an electronic prepress system employing a platesetter shown from a side view with a plate handler and plate picker mechanism according to the present invention;

Figure 2 is a partial sectional front view of the plate handler viewed in Fig. 1;

Figure 3 is an isometric view of an assembly portion of the plate handler shown in Fig. 2, particularly featuring an elevator mechanism and a table supporting mechanism according to the present invention;

Figure 4 is a detailed isometric view of the plate picker mechanism shown in Fig. 1;

Figure 5 is a simplified top view of the picker mechanism of Fig. 4 positioned over a handler cassette within the plate handler according to the present invention;

Figure 6 is a side view of a portion of the plate handler showing the plate picker in the process of picking a plate from a cassette, and also featuring a slip sheet removal mechanism according to the present invention;

Figure 7 is an isometric view of a plate cassette used in the plate handler according to the present invention; and

Figure 8 is a detailed side sectional view of a portion of a plate cassette as shown in Fig. 7

DETAILED DESCRIPTION OF THE INVENTION

The computer to plate imaging system shown in Fig. 1 and generally referred to as reference number 10, is a complete system for plate production, where digital data files representing a publication (or printed image) are input to the system 10, and plates ready to go on a printing press are output from the system 10. Most of the operation of the system is automated, requiring a minimum of operator intervention. The system is comprised of a front-end server 12, a raster image processor (RIP) 14 and a platemaker or platesetter 16. The front-end 12 sends jobs to the platesetter 16. The platesetter 16 has three major components. An optional on-line plate handler 18, the imaging engine 20 and an optional on-line plate processor/plate stacker 22. The plate handler 18, hereinafter handler, contains a supply of plate containers or cassettes 24. The handler can hold as little as two cassettes or as many as three, four, or five depending on user requirements. Each cassette is a light tight container that houses a stack of plates 26. The cassettes 24 can be vertically adjusted by the handler 18 to make plates 26 stored within a particular cassette available to a plate shuttle mechanism 28, hereinafter referred to as the picker 28. The picker 28 removes a single plate from the selected cassette and transports the plate between the handler 18 and the engine 20, which will be described in detail hereinafter.

The primary function of the handler 18 is to make plates 26 available on demand to the imaging engine 20. A multitude of plates 26 are stacked in each cassette 24 and the cassettes 24 are side-loaded into the handler 18 by an operator. Between each plate in a stack there may be a protective interleaf sheet or slip sheet which is removed by the handler 18 and discarded by a slip sheet removal mechanism 25. The handler 18 receives commands from the engine 20 by workflow software, which provides instructions to the handler 18 about what cassette 26 needs to be accessed to make a plate available to the picker 28 so the plate may be conveyed to the imaging engine 20. The handler 18 in turn provides status information to the engine 20 through the workflow software to make full interaction with the system 10 possible.

The front-end 12 sends data to the engine 20 through an interface connection. Typically this data represents a ÒjobÓ which requires the imaging of plates.

guide wheels 96 which engage the rails 90 (or 92) on each side of the carriage 94. Also two friction wheels 98 engage the rails 90 (or 92). The friction wheels 98 are driven by a motor 100 mounted on the carriage 94 through a connection to a drive shaft 102 and a belt and pulley mechanism 104 on each side of the carriage 94. The motor 100 operates in two directions to effectively propel the picker carriage 94 in forward and reverse from the engine compartment 20 to the handler 18. The carriage 94 supports three rows 106, 108, 110 of suction cups and an associated vacuum manifold 112 and vacuum tubing (not shown) between the manifold 112 and the three rows 106, 108, 100 of suction cups. The suction cups 114 are mounted on spring loaded fittings 116 to allow compression of the suction cups 114 against a plate during picking to ensure attachment of the plate to the picker 28. The first row 106 of suctions cups that extends the furthest into the handler 18 is pivotable with respect to the carriage 94. An eccentric drive 118 and linkage 120 pivots the first row 106 of suction cups in a ÒpeelingÓ motion. The eccentric 118 is driven by a motor 122 mounted on the carriage 94 to break or peel the edge of the plate being picked away from the stack. The middle row 108 of suction cups remains fixed with respect to the picker carriage 94. The third row 110 of suction cups slides out from the middle row 108 of suction cups. Two circular rails 124, 126 are mounted for sliding through complementary bearings (not shown) in the carriage body 94 on the both sides of the picker 28. On the right side of the picker viewed in Fig. 4, the circular rail 126 has a friction drive wheel (not shown) is in driving contact with the circular rail 126. The drive wheel is driven by a drive motor 128 through a belt and pulley mechanism (not shown), all of which are mounted to the carriage body 94 so as to transmit rotary motion of the drive wheel into linear motion of the circular rails 126, 124 relative to the carriage body 94. The third row 110 of suction cups being movable relative to the other rows 106, 108 of suction cups expands the overall size of the picker 28 and the coverage area of the suction cups 114 to accommodate for various sized plates.

Fig. 5 illustrates a simplified top view of the picker 28 positioned over a cassette 24 in the handler. The first row 106 of suction cups 114 is positioned near an inner edge 130 of the cassette 24 against which the plates are referenced regardless of the plate size. Four different plates having different sizes are depicted by dashed lines and are indicated as plates A, B, C, and D. Plate A is the smallest plate and the middle row 108 of suction cups of the picker 28 is positioned near the opposite edge 132 of plate A from the reference edge 130. The middle row 108 has a fixed position relative to the first row 106 (excepting that the first row is pivotable) to pick up plate A without the use of the third row 110 of suction cups. The third row 110 is shown in an extended position by solid lines, at the far edge 134 of the largest plate D opposite from the reference edge 130. The third row 110 of suction cups is also shown by dashed lines in a non-extended position. The third row 110 of suction cups is used to expand the size of the picker 28 to cover the areas for various size plates, such as B, C, and D, larger than the smallest plate A and smaller than or equal to the largest plate D, as indicated by arrow 136. Arrow 138 shows the relative movement of the picker 28 including all three rows 106, 108, 110 of suction cups 114 with respect to the handler cassette 24 and the engine.

Referring now to Fig. 6, the slip sheet removal mechanism is generally indicated as 25. The mechanism 25 is for the purpose of preventing a slip sheet 140 from sticking to the bottom of a plate 142 which is attached to the picker 28, securing the slip sheet 140 on the top of the stack of plates in a cassette 24 to the slip sheet removal mechanism 25, and subsequently completely removing the slip sheet 140 from the stack of plates in the cassette 24. The mechanism 25 comprises a plurality of suction tubes 144 mounted on a first pivotable shaft 146, an optional peeler air blast 148, a plurality of fingers 150 mounted on a second pivoting shaft 152, a plurality of nip wheels 154 mounted on a third pivoting shaft 156 (only one of each seen in drawing due to side view), and a rotatably driven roller 158 positioned below the nip wheels 154 which are in rolling contact during part of the slip sheet removal process, to be described hereinafter. The suction tubes 144 are fixed to the pivoting shaft 146 to pivot upon being driven by motor 160 through a drive belt and pulley connection 162. The fingers 150 are fixed to pivoting shaft 152 which is driven by a similar drive connection to a motor (not shown). The nip wheels 154 are each mounted to an extension arm 164 which is attached to a bracket 166 mounted on the pivoting shaft 156. The extension arm 164 is spring loaded at the connection to the bracket to allow for the extension arm 164 to pivot or give slightly while pressure is applied between the nip wheel 154 and the roller 158. The shaft 156 is rotated in forward and reverse by the drive motor 168 through a drive belt and pulley connection 170. The roller 158 is driven by a motor 172 also through a belt and pulley connection 174. It will be understood by those skilled in the art that equivalent means for rotating the pivoting shafts 146, 152, 154, and rotating roller 158, may be substituted therefor without departing from the spirit of the invention. The driven shafts and motors for driving the shafts are all mounted to a mounting bracket 176 which is connected to the support beams 46 of the handler 18. Operation of the slip sheet removal mechanism 25 will be described hereinafter.

Referring now to Fig. 7 and Fig. 8, a cassette 24 for loading into the plate handler is shown. The cassette has a removable cover 180, which is removed and replaced in a vertical direction relative to a rectangular bottom container 182 as indicated by arrows. The bottom container 182 comprises a base plate 184 surrounded by four aluminum side extrusions 186. The

door position, and down and horizontally as shown in the figure for an open, cassette loading position.

Cassettes loaded into the handler house the plates. At any one time, a cassette holds only like plates (same type, gauge, size, etc.). Typically, there is a maximum of 50 plates of 0.012" gauge, 75 plates of 0.008" gauge, or 100 plates of 0.006" gauge, in a single cassette. There are several distinct cassette sizes. A cassette of a specific size holds a range of plate sizes inside, however only one size plate is loaded into a cassette at any one time. Fillers or guides are used to take-up the space between plate and cassette boundaries. The reference position of the plates within the cassette is described above with reference to Fig. 5.

Packaging of plates within a cassette is related to both handler operation and cassette transportability. There may be a mix of cassettes in the handler (two, three or four cassettes) All cassettes can be different from each other, in that each houses a distinct set of plate characteristics (type, size, gauge, etc.) There may be instances where some or all cassettes inside the handler have the same plate characteristics.

Now, with reference to all the Figures, the method for using the plate handler 18 and picker 28 will be described. The primary function of the handler 18 is to position a required plate on demand in an access position for the picker 28, which picks and delivers the required plate to the engine 20. Once the handler 18 receives a request from the engine 20 for a specific plate, the following actions take place in the handler, in cooperation with the engine 20. The picker 28 begins in the home position within the engine 20. The slip sheet removal mechanism 25 is positioned with the suction tubes 144, fingers 150, and nip wheels 154 retracted (as shown in dotted lines for the suction tubes and nip wheels in Fig. 6) to clear the path of the tables 34, 36 for repositioning by the elevator mechanism 40. The elevator mechanism 40 moves the brace 38, lower table 36, and upper tables 34 supported thereon, if any, to a cover removal/replacement position. In the cover removal/ replacement position, the selected table 36 is located directly below the table 34 supported by the support bars 56 of the table support mechanism 44. Hooks on the bottom of the supported table 34 engage the cover 180 of the selected cassette 24 for either removal or replacement, so that the cover 180 is separated from or rejoined with the selected cassette 24.

In Fig. 2, the cover removal/replacement position for the lower table 36 is at a position where the open cassette 24 on the lower table 36 contacts the cover 180 supported by the table 34 immediately above the lower table 36 held by the support bars 56. When the selected cassette 36 is in the cover removal/replacement position, the upper tables 34 are all then supported by the brace 38. Then the support bars 56 and shafts 52 are turned 90 degrees by means of the linkage 60 and drive motor 64. Once the support bars 56 are retracted from the path of motion of the tables 34, 36, the elevator mechanism 40 moves to the cover removal/replacement position for the next selected table and cassette. The table support mechanism 44 moves the support bars 56 into the supporting position underneath the table directly above the selected cassette 24. The elevator mechanism 40 then moves the selected table down thereby separating the cover 180 of the selected cassette 24 from the selected cassette 24 so that the picker can access the plates 26 contained within the cassette 24.

The picker 28 is then moved from the home position in the engine 20 into the handler 18 along the rails 90 and 92. Depending on the size of the plate in the selected cassette 24 the picker 28 adjusts the third row 110 of suction cups relative to the middle row 108 of suction cups to accommodate for various plate sizes, if necessary (Fig. 5). The elevator mechanism 40 moves the selected cassette 24 and plates therein upward to come into contact with the suction cups 114 on the picker 28 (Figs. 4 and 6). The suction cups 114 retract into the spring loaded fittings 116 to accommodate for variations in the stack height of the plates 26 in the cassettes 24, as the elevator 40 moves the cassette 24 up to the picking position which is at a set vertical height relative to the picker rails 90b, 92b. Therefore for a maximum stack height of a full stack of plates, the suction cups 114 compress against the spring loaded fittings 116 and retract a length into the fittings, and for a depleted stack of plates, the suction cups 114 compress against the spring loaded fittings and retract substantially the same length minus the height of the stack depletion. The spring loaded fittings 116 also ensure that the plate and the suction cups 114 make contact to secure the plate onto the picker 28. After the plate is attached to the picker 28 by the vacuum suction, the first row 106 of suction cups on the picker 28 is pivoted upward, peeling back the edge of the plate 142 and creating a gap between the plate 142 and the slip sheet 140 underneath.

The slip sheet removal mechanism 25 activates the peeler air flow 148, and the fingers 150 are pivoted into position to hold down the edge of the slip sheet 140 while the elevator mechanism 40 lowers the cassette 24 to a slip sheet removal position. The peeler air blast 148 remains on while the cassette 24 moves downward to separate the slip sheet 140 from the bottom of the plate 142 being picked by the picker 28, which may stick to the plate due to electrostatic charge. The fingers 150 are pivoted away from the slip sheet 140 and the suction tubes 144 are pivoted into position above the slip sheet edge. The suction cups on the ends of the suction tubes are compliant and flexible so that when the vacuum is applied and contact is made between a suction cup and the slip sheet, the slip sheet material is drawn into the suction cup and the separation of the slip sheet from the plate below it is initiated. The compliant suction cup deforms to break the slip sheet away from the lower plate as typically an attractive force exists between the

engine (20);

d. automatically removing a single plate from the stack of plates (20) in the access position and delivering the plate to the imaging engine (20);

e. imaging the job onto the plate (26) in the engine (20); and

f. processing the imaged plate (26) in a processing device (22).

2. The method according to claim 1, further comprising the steps of:

a. transferring a digital file representing an image to be printed from a front end server (12) to a RIP (14);

b. processing the digital file in the RIP (14) to a job to be outputted by the automated platesetter (16); and

c. sending the processed job from the RIP (14) to the imaging engine (20) in the platesetter (16);

3. The method according to claims 1 or 2, further comprising the step of removing a slip sheet (140) if present from top of the stack of plates (26) in the access position.

4. The method according to claims 1 or 2, further comprising the step of exchanging information between the imaging engine (20) and the plate handler (28), including the plate size required by the job and the quantity available of the plate size required by the job.

5. The method according to claims 1 or 2, wherein said step of automatically positioning a stack of plates (26) required for the job by the imaging engine (20) can occur during delivery of a previous plate to the imaging engine.

6. An apparatus for making printing plates in an automated platesetting system, comprising:

a. an automated platesetter (16) comprising a plate handler (18) and an imaging engine (20), said imaging engine having means for requesting a plate (26) of a particular size required by the job from the plate handler;

b. means for automatically positioning a plurality of stacks of plates (18, 26) stored in the plate handler (18) to place a stack of the plate size required by the job in an access position relative to the imaging engine (20);

c. means for automatically removing a single plate from the stack of plates (26, 28) in the access position and delivering the plate to the imaging engine (20);

d. means for imaging (20) the single plate (26) in the engine according to the job and forming the image represented by the digital file; and

e. means for processing the imaged plate (22, 26).

7. The apparatus according to claim 6, further comprising:

a. a front end server (12) containing a digital file representing an image to be printed;

b. a RIP (14) connected to the front end server (12) and processing the digital file received from the front end server into a job to be outputted; and

c. the automated platesetter (16) connected to said RIP (14), said RIP sending the processed job to the imaging engine to be outputted.

8. The apparatus according to claims 6 or 7, wherein said stacks of plates (26) are stored substantially horizontally.

9. The apparatus according to claims 6 or 7, wherein said stacks (26) are moved in a substantially vertical direction by said means for positioning (18).

10. The apparatus according to claims 6 or 7, wherein said platesetting system (16) is capable of outputting a proof of an image to be printed.

11. The apparatus according to claims 6 or 7, further comprising means to detect (25) whether a slip sheet (140) is present on top of the stack of plates (26) in the access position.

12. The apparatus according to claims 6 or 7, further comprising means for removing a slip sheet (25, 140) when present on top of the stack of plates (26) in the access position.

13. The apparatus according to claims 6 or 7, wherein said means for removing a plate (25, 26) from the stack of plates in the access position moves substantially horizontally with respect to said stacks of plates to transfer the plate from the horizontal stack in the access position to the imaging engine (20).

14. The apparatus according to claims 6 or 7, further comprising means for exchanging information between the imaging engine (20) and the plate handler (18), including the plate size required by the job and the quantity available of the plate size required by the job.

15. The apparatus according to claims 6 or 7, further comprising means for reading information from a plurality of cassettes (24) each containing a stack of

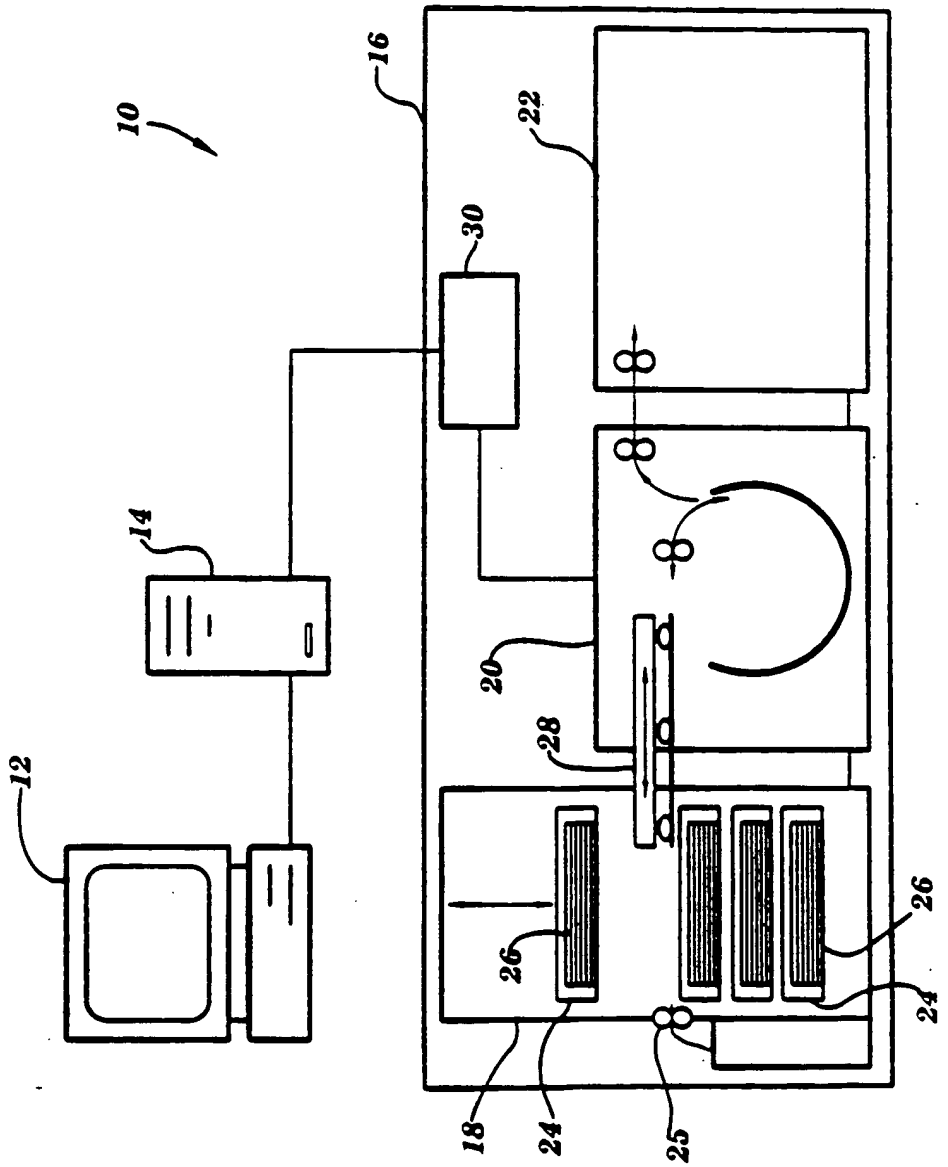

FIG. 1

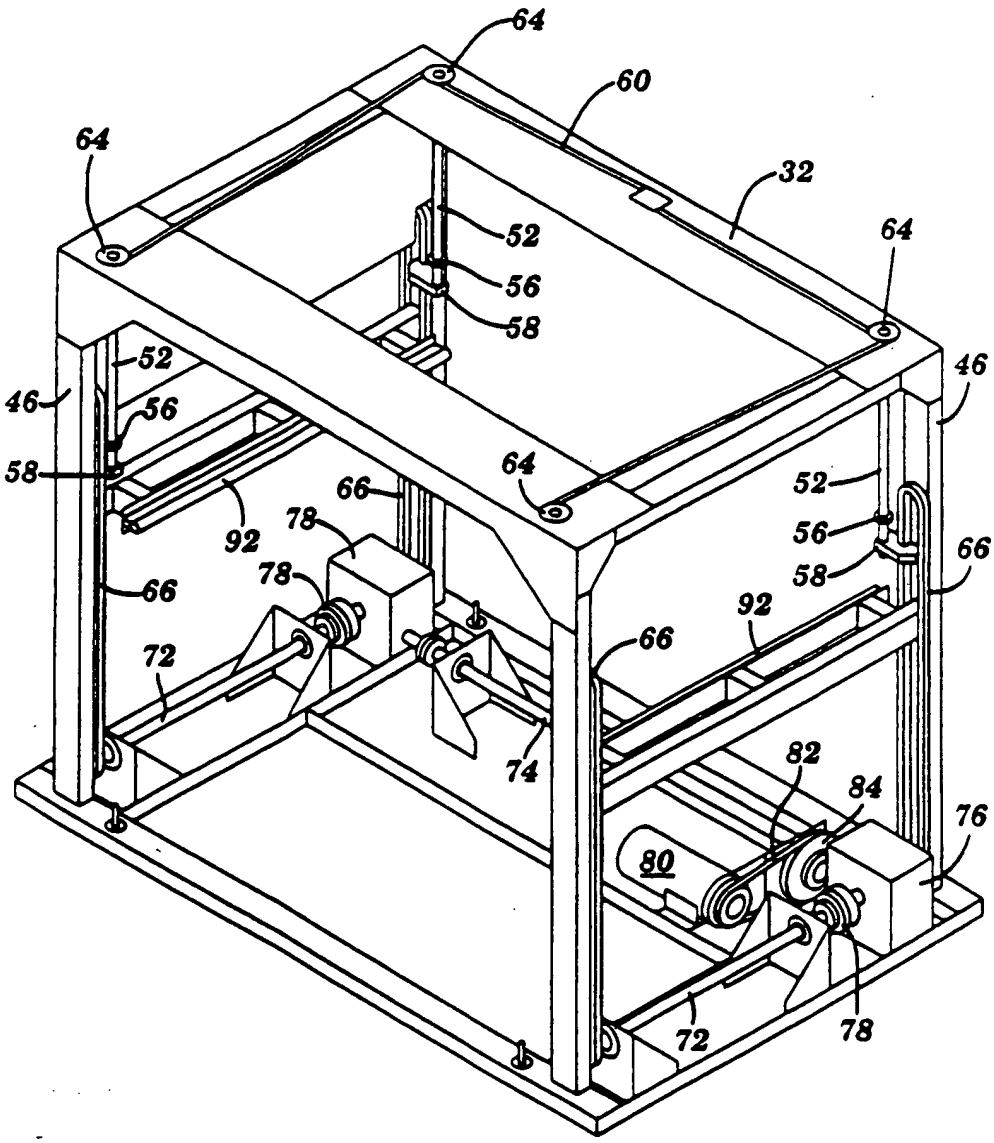
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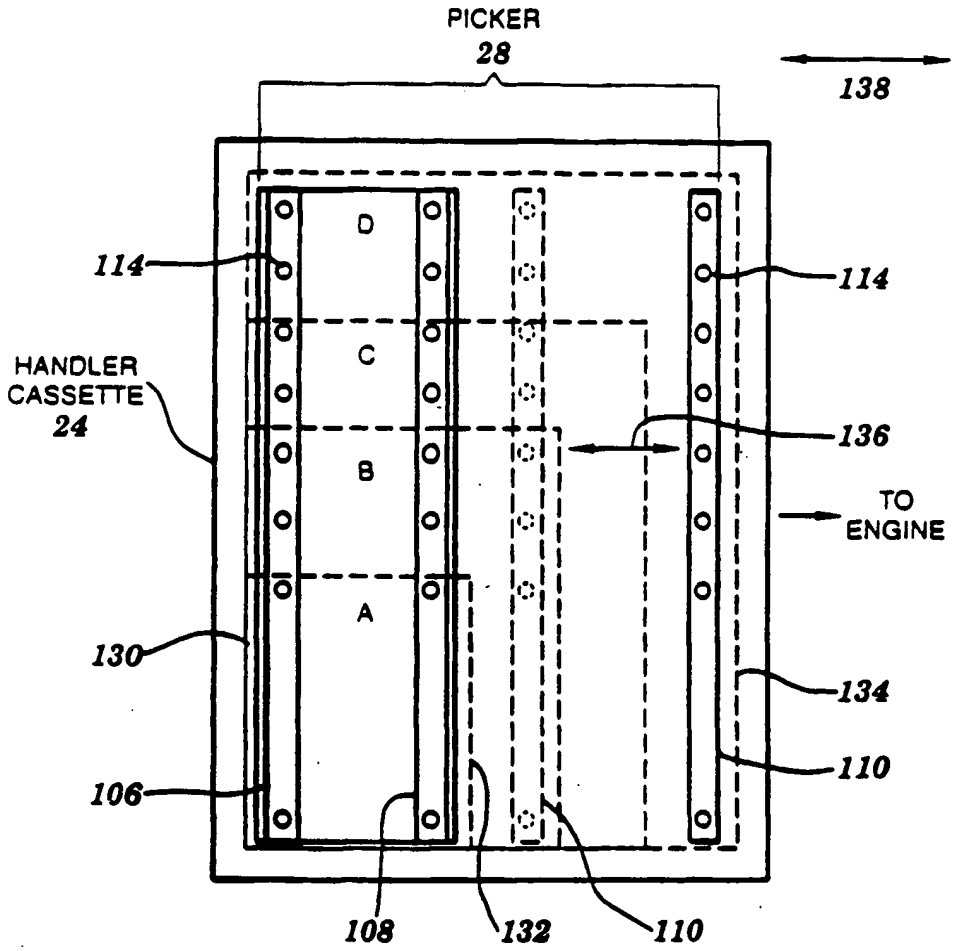
FIG. 3


PICKER
28
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D
C
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HANDLER
CASSETTE
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TO
ENGINE
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132
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FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 20 1818

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	DE 40 38 544 A (KRAUSE-BIAGOSCH GMBH) * the whole document *	1,6,8,9,13,16 2-5,7,10-12,14,15,17,18	G03F7/20
A	US 5 094 933 A (UHRIG) * column 1, line 36 - column 4, line 41 *	1,2,4,6,7,10,14,16-18	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G03F
B65H
G03B
B41C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 November 1997	Balsters, E

CATEGORY OF CITED DOCUMENTS

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